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Dobrinsky, R.

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International Institute for
Applied Systems Analysis
Schlossplatz 1
A-2361 Laxenburg, Austria

Tel: +43 2236 807 342
Fax: +43 2236 71313
E-mail: publications@iiasa.ac.at
Web: www.iiasa.ac.at

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Convergence in Per Capita Income Levels, Productivity Dynamics and Real Exchange Rates in the Candidate Countries on the Way to EU Accession

Rumen Dobrinsky (Rumen.Dobrinsky@unece.org)

Approved by

János Gács (gacs@iiasa.ac.at)
Project Leader, Economic Transition and Integration

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Abstract

One of the greatest challenges of the present round of eastern enlargement of the EU is the unprecedented gap in per capita incomes between incumbents and candidate countries and even under favorable future growth assumptions, the candidate countries still face a long process of catching up. During a catch up process there emerges an essential and fundamental economic link between nominal and real variables and hence real convergence cannot be de-coupled from nominal convergence. The link between the two surfaces in the dynamics of the real exchange rate through the "Balassa-Samuelson effect".

This paper analyzes convergence in per capita income levels between present EU-member states and candidate countries and some of the implications of this process for the candidate countries addressing three main groups of issues. The first one is related to the empirical measurement of a catching up process and convergence between candidate countries and EU-member states and the paper provides some broad measures of these income gaps and their dynamics during the past decade. The second group of issues is that of the sources and economic fundamentals of a catch up process. It is argued that for a catch up process to be self-sustained, it must be based on differential productivity growth in which productivity in the candidate countries grows faster than that in the incumbent EU-member states. The third group of issues is related to the dynamics of the real exchange rate during a productivity catch up process and the implications of the Balassa-Samuelson effect. The paper analyzes the dynamics of the real exchange rates in the candidate countries and attempts to test empirically the Balassa-Samuelson effect in these countries. The paper concludes with a discussion of some of the policy implications of the dichotomy "real-cum-nominal convergence" and of the emerging "catch up inflation" for the candidate countries on the way to EU accession.

JEL classification numbers: C33, E52, O47.

Keywords: convergence, total factor productivity, real exchange rates, Balassa-Samuelson effect.

Foreword

by János Gács

This paper is one of the results of a broad, multi-year research project of the Economic Transition and Integration Project of IIASA entitled "Catching Up and EU Accession – Prospects for First and Second Wave Countries". The research was particularly encouraged by IIASA's Swedish and Hungarian national member organizations, while financial support was provided by the (then) Swedish national member organization, the Swedish Council for Planning and Coordination of Research (FRN). Preparations for the project started in 1999. In addition to other forms of communication two workshops, one in Budapest in January 2000, and one in Stockholm in May 2001, helped to elaborate the research agenda, coordinate collaborative work and discuss results. Publication of the studies prepared in the framework of this projects started in September 2001.

The main ideas of the research project can be summarized as follows.

The accession of the Central and East European countries (CEECs) to the EU is likely to lead to conflicts between these countries and the incumbent members unless there is a rapid narrowing of the gap in per capita incomes between them. The CEECs are much poorer and have proportionately much larger agricultural sectors than the average EU country, and their combined populations make up between one-fourth and one-third of that of the current EU. Due to these characteristics there is concern in EU member states about a mass migration from the East following accession, about social and environmental "dumping" from CEECs, and about an increased demand by the CEECs on the EU's Structural and Cohesion Funds, as well as on the funds provided under the Common Agricultural Policy.

These concerns, however, are counterbalanced to a large degree by a "catching up" predicted by both theory and experience: poorer countries, unless their development is impeded by institutional barriers, usually develop faster than richer ones, and there is a tendency toward convergence in levels of GDP per capita. In recent years, this catching up process seems to have started. In addition, trends in capital inflows and stock market developments suggest that the expected return on capital in the region is sufficiently high to support the buildup of stronger production capacities.

The research project on catching up studied the pattern according to which preparations for membership can trigger changes that will affect the growth process before and after membership. Special attention was paid to CEECs in different positions: those that started negotiations in 1998 and may reach membership first, and those that started negotiations in 2000. The effects on the sources of growth in both the pre-accession and post-accession periods were studied.

The following specific topics were investigated by the contributors of the project: the relevance of the export led East Asian development experience for CEECs; the forces of convergence and divergence that worked in the less developed EU member states (Spain, Portugal, Ireland and Greece) following their accession; the mixed experience of East Germany in catching up in a growth theoretic perspective; the role of domestic savings and savings behavior in the catch-up process; the likely pattern of the so-called Balassa-Samuelson process (real appreciation associated with the expected rapid productivity growth) in the course of the convergence; evaluation of the possible effects of EU structural aid on the candidate countries' development based on the experience of the cohesion countries of the EU; financial convergence of the candidate countries to the EU and the growth process; the role of institutions in the process of transition and catching up; and the relationship between the growth process and human development (health, education, standard of living, including inequality) in the context of EU accession.

Acknowledgments

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About the Author

Rumen Dobrinsky works at the Economic Analysis Division of the UN Economic Commission for Europe, Geneva. In 2000-2001 he participated in the research project „Catching Up and EU Accession – Prospects for First and Second Wave Countries" of the ETI project of IIASA.

Convergence in Per Capita Income Levels, Productivity Dynamics and Real Exchange Rates in the Candidate Countries on the Way to EU Accession

Rumen Dobrinsky

1. Real convergence, nominal convergence and "catch up" inflation

A cohesive co-habitation in a club of nations, such as the EU, requires a high degree of convergence among the member states in terms of their economic performance.[1] This requirement refers with an equal force to the institutional environment, to the real and to the nominal economy. Each of these three components plays an essential role for the smooth integration of the economies participating in a union. The past experience of the EU clearly indicates that at each stage of the evolution of the union the deepening of the process of economic integration only became possible when there was sufficient degree of convergence in all three aspects noted above.

What is specific in the forthcoming round of enlargement of the European Union, is the dominating number of relatively low income economies. While in the past there have been cases when candidate countries had to achieve considerable progress in meeting the goal of real convergence (that is, the existence of large income disparities and the need to bridge the gaps in per capita income levels among countries), the latter never was the major problem; besides, this has been rather the exception than the rule. The adopted criteria for participating in the EMU[2] incorporate the implicit assumptions of mature, similar and converging economies, as indeed was the case when these criteria were put forward for the potential participants in such a union. These criteria focus mainly on the "fine tuning" elements of economic and monetary convergence, leading to the ending phase of an integration process that started decades ago.

The process of European economic integration as revealed in the evolution of the EU has been in the past – from its inception and until the turn of the century – a

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1 The very notion of economic convergence has a variety of connotations. In the broad sense it merely denotes various degrees of similarity in the observed patterns of economic performance. In the more narrow sense of real convergence, it connotes a reduction of the gaps in (per capita) income between different economies.

2 The most popular among these pre-requisites (although probably there is an element of undue oversimplification in their everyday use) are the quantitative criteria of macroeconomic performance that have come to be known as the "Maastricht convergence criteria".

negotiated partnership between equals in terms of developmental levels. The fact is that the principal present mechanisms embodying economic integration within the EU – the EMU and in the *acquis communautaire* – while covering possible income disparities between member states and regions thereof, are not designed to tackle the issue of real convergence of a great magnitude. Thus one of the greatest challenges of the present round of eastern enlargement of the EU is the unprecedented gap in per capita incomes between incumbents and candidate countries.[3] The fact is that the time distance in terms of per capita income levels between most of the accession candidates (from among the former centrally planned economies) and the European Union can still be measured in decades. That is, even under favorable future growth assumptions, they still face a long process of catching up before they reach the income levels and living standards prevailing in western Europe.

At the same time – in view of the existing norms governing the preparation for EU accession – the aspect of real convergence practically is not covered in the chapters that are being negotiated with the candidate countries which cover basically the issues of nominal and institutional/regulatory convergence. There are a number of problems – and policy dilemmas – that arise from this asymmetric treatment of the three aspects of convergence. In particular, during a catch up process there emerges an essential and fundamental economic link between nominal and real variables that often tends to be neglected but which is likely to have profound economic implications for the acceding transition economies. The fact is that real convergence cannot be de-coupled from nominal convergence as these are essentially the two sides of one and the same coin; the link between them is given by the dynamics of the real exchange rate.

The long-term dynamics of the real exchange rate reflects fundamental structural changes in the economy which lead to permanent shifts in the relative positioning of some important macroeconomic variables.[4] In particular, a robust theoretical finding in the economic literature (which has also been verified in numerous empirical studies) is the link between changes in relative productivity and the associated changes in the structure of relative prices which is usually referred to as the "Balassa-Samuelson effect" (Balassa, 1964; Samuelson, 1964). This notion is used to characterize a variety of implications which result from the incidence of a differential in productivity levels and/or in productivity dynamics between two or more economies, or between sectors within an economy (in particular the productivity and price differentials between the tradable and non-tradable sectors). The Balassa-Samuelson conjecture implies that

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[3] Throughout the paper "candidate countries" are defined as the former centrally planned economies that have either started accession negotiations with the EU or have been identified as potential candidates for EU accession. The group of countries actually covered in the empirical part of the paper has been confined by the availability of relevant data.

[4] The "real exchange rate" in general reflects the relative price of domestic goods and services vis-à-vis the price of foreign goods and services and there are various ways of defining a real exchange rate. The most commonly used definitions are based on the "double deflation" of the nominal exchange rate in which the latter is deflated by the differential between domestic and foreign prices (or between domestic and foreign unit labor costs). Another way to present a real exchange is to take the relative (domestic) price of non-tradable goods vis-à-vis the (domestic) price of tradable goods (the so called "domestic terms-of trade"). Yet another definition is the "exchange rate deviation index" discussed in the next section.

economies that are systematically characterized by higher levels of productivity would also tend to have currencies that are relatively more "expensive" in nominal terms than the currencies of less productive economies. Another implication is that a productivity differential between a low income and high income economy entails "catch up inflation" which can in no way be related of disequilibria in the economy but merely mirrors the fact that a productivity catch up involves at the same time a catch up in price and wage levels.

This paper analyzes convergence in per capita income levels between present EU-member states and candidate countries and some of the implications of this process for the candidate countries addressing three main groups of issues. The first one is related to the empirical measurement of a catching up process and convergence between candidate countries and EU-member states. Section 2 provides some broad measures of these income gaps and their dynamics during the past decade. The second group of issues is that of the sources and economic fundamentals of a catch up process. It is argued that for a catch up process to be self-sustained, it must be based on differential productivity growth in which productivity in the candidate countries grows faster than that in the incumbent EU-member states. Section 3 presents a comparative assessment of the dynamics of total factor productivity in these countries during the 1990s. The third group of issues is related to the dynamics of the real exchange rate during a productivity catch up process and the implications of the Balassa-Samuelson effect. Section 4 analyzes the dynamics of the real exchange rates in the candidate countries and attempts to test empirically the Balassa-Samuelson effect in these countries. Section 5 then takes up in more detail some of the policy implications of the dichotomy "real-*cum*-nominal convergence" and of the emerging "catch up inflation" for the candidate countries on the way to EU accession.

The main argument in the paper is that if the acceding countries will be growing faster than the EU during the preparation for EU accession (as they should be, in order to reduce the existing income gaps), their economies are likely to be subject to the Balassa-Samuelson effect. While this type of fundamental structural change has important economic implications, plainly, this aspect has not been assigned due priority in the present phase of the negotiation rounds. For example, one of the central macroeconomic aspects of the ongoing negotiations is the attainment of nominal convergence (that is, convergence of inflation rates with the EU) in the acceding countries, which is often treated as an immediate policy goal, disregarding its links with the process of real convergence. As argued in this paper, if the candidate countries aim at real convergence on the EU in per capita income levels, they are likely to be faced with catch up inflation which will accompany a productivity catch up. The catch up inflation is a fundamental and equilibrium feature of a productivity differential and its emergence does not imply policy inconsistency; on the contrary, the paper argues, trying to artificially suppress catch up inflation may have damaging economic consequences and may in fact push the economy away from its equilibrium growth path.

2. The income gap between the EU-member states and the candidate countries

There are numerous methodological and practical problems related to the cross-country comparison of per capita income levels and it was only recently that data sets of acceptable standards and quality were compiled. The most widely used data set of this type are so called Penn World Tables (PWT) which contain comparable per capita GDP data for more than 130 countries starting from 1950 (Summers and Heston, 1988 and 1991). Another commonly used set of data that covers a smaller number of (mostly industrialized) countries but for a longer period of time was that developed by Maddison (1995). Despite the continuing efforts, the quality of the data is in general far from being satisfactory which weakens the analytical power of the conclusions that can be drawn from them.

The data problems are even more severe as regards the former centrally planned economies of central and eastern Europe; these problems have been aggravated by the redrawing of national borders in this part of the continent after the start of economic and political transformation. The available past estimates for the former centrally planned economies present some basis for longer-term comparative studies (ESE, 2000); however, their analytical power with respect to current analysis is limited by both by the changes in national boundaries and by the methodological deficiencies in the data. Due to this, the comparisons presented below are based on the results of the 1996 European Comparison Programme (ECP, 1999) which provides comparable estimates of per capita GDP levels at PPP for almost all European economies. This point estimate has been extrapolated backwards and forwards on the basis of nationally reported GDP growth rates to produce series covering the whole decade of the 1990s.

Some results from this exercise are given in Table 1.[5]

In general the data indicate not only relatively rather low level of per capita GDP levels in the candidate countries but also substantial variation in those levels among them (in 2000, it ranges from 15% of the EU average in Albania to 76 of the EU average in Slovenia). On the other hand, the level of per capita GDP (at PPP) in some candidate countries as the Czech Republic and Slovenia in 2000 was higher than that in some EU-member states as Greece and Portugal.

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5 Here and in the further calculations the group of candidate countries comprises the usual 10 Central and East European candidate countries and Croatia. In the calculations presented in Tables 2 and 3 the group comprises also Albania and FYR Macedonia.

Table 1. Per capita GDP in the candidate countries and in the EU-member states (at 1990 PPP and at current exchange rates) and exchange rate deviation indexes

	Per capita GDP (EU-15=100) (at 1990 prices and PPP)			Per capita GDP (EU-15=100) (at current exchange rates)	Exchange rate deviation index (PPP/ex. rates) (at 1966 PPP)
	1990	1995	2000	1996	1996
Candidate countries					
Albania	15.8	14.1	15.3	3.6	3.37
Bulgaria	32.5	29.1	25.1	5.1	4.28
Croatia	41.5	30.3	31.8	19.2	1.43
Czech Republic	70.3	65.8	63.1	24.3	2.26
Estonia	44.2	33.4	39.5	12.9	2.23
Hungary	55.1	49.0	54.9	19.2	2.08
Latvia	49.1	25.5	29.4	8.9	2.45
Lithuania	50.5	29.0	30.0	9.2	2.71
FYR Macedonia	31.0	22.0	21.6	8.9	1.86
Poland	32.2	35.8	40.8	16.2	1.86
Romania	37.1	33.6	27.6	6.8	4.26
Slovakia	51.8	43.6	48.6	15.9	2.39
Slovenia	70.1	67.5	76.4	41.1	1.40
EU-member states					
Austria	105.9	106.8	106.2	123.1	0.78
Belgium	105.5	106.0	107.2	114.6	0.85
Denmark	108.0	114.6	114.6	144.2	0.74
Finland	102.3	92.8	102.5		0.78
Germany	101.0	101.2	99.6	124.7	0.74
Greece	57.7	57.1	59.2	50.7	1.13
France	109.6	108.0	107.6	114.2	0.78
Ireland	72.0	89.7	115.5	84.7	0.94
Italy	102.2	102.6	98.2	91.8	0.97
Luxembourg	150.1	174.8	177.9	177.3	0.82
Netherlands	100.8	103.3	105.9	110.7	0.83
Portugal	60.8	63.5	66.5	45.3	0.78
Spain	73.6	74.6	78.5	64.6	1.01
Sweden	107.5	102.2	103.1	123.5	0.69
United Kingdom	100.2	100.7	100.7	85.1	1.00

Source: Author's calculations on the basis of data from the UNECE statistical data base.

Table 1 also illustrates the gap in GDP per capita levels when the latter is measured at current exchange rates; not surprisingly, as it also follows from the arguments put forward in the previous section, this gap is considerably larger than that measured at PPP. The last column of Table 1 contains the exchange rate deviation indexes defined as the ratios between the PPP and the average nominal exchange rates[6] for the year 1996 and computed on the basis of the results of the latest (1996) round of the European Comparison Programme (ECP, 1999).[7] As can be seen, while the deviation indices for the high income countries (the EU-member states) are close to one (meaning that the observed exchange rates among the EU-member states were close to their purchasing parities), the exchange rate deviation indices for the acceding countries were in general substantially larger than one. In general, these data are in line with the findings of other comparative studies, which suggest that the discrepancies between the nominal exchange rate and the domestic purchasing power tend to be inversely associated with the level of per capita income.[8]

From the perspective of the now existing purchasing power disparities, if the acceding countries start improving their relative per capita income position vis-à-vis the EU, they will at the same time experience a reduction in their exchange rate deviation indices. Applied to the context of the envisaged EU accession, this means that as long as the process of catching up on the EU in productivity and income levels continues, it is going to be accompanied by a parallel process of real appreciation of the transition economies' currencies vis-à-vis the Euro (assuming that the latter takes on its planned function of a single currency).

Since catching up implies reduction of the income gaps, one of the questions that would need to be addressed is whether there is evidence in recent years of convergence in per capita income levels between candidate countries and EU-member states. There has been a long debate in the economic literature of various aspects – theoretical as well as empirical – of the notion of (real) convergence and its theoretical foundation. Three main convergence hypotheses have been formulated (Galor, 1996):

- the absolute (unconditional) convergence hypothesis – per capita incomes of countries converge to one another in the long run independently of their initial conditions;

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6 So defined, the exchange rate deviation index can be regarded as a specific definition of the real exchange rate. Its emergence is another form of the Balassa-Samuelson effect: a difference in productivity levels leads to the emergence of a discrepancy between the actual purchasing power of the currencies and the market determined nominal exchange rates established between them.

7 The actual deviation of nominal exchange rates from their domestic purchasing power parities has been identified and measured empirically in a number of studies devoted to the cross-country comparison of income levels (which in turn result from differences in productivity) which have shown that per capita income disparities among countries are positively correlated with such deviations. See Kravis, Heston and Summers (1981).

8 This link is to be interpreted in statistical terms (as a distribution along a trend line).

- the conditional convergence hypothesis – per capita incomes of countries that are identical in their fundamental structural characteristics converge to one another in the long run independently of their initial conditions;

- the "club convergence" hypothesis (polarization or clustering) – per capita incomes of countries that are identical in their fundamental structural characteristics converge to one another in the long run, provided their initial conditions are similar as well.

Empirical work on testing these hypotheses largely relies on the actual measurement of the process of convergence between countries and nations. Two main quantitative definitions of convergence have been suggested in the literature (Sala-i-Martin, 1996):

- ß ("beta") convergence denotes (in the context of the absolute convergence hypothesis) a long-term phenomenon in the course of which poor economies tend to grow faster than rich ones;

- in turn, σ ("sigma") convergence signifies diminishing variation in the per capita income levels between a group of economies.

In general, the evidence of economic convergence in the global economy is mixed and various studies have come up with different and sometimes conflicting results and conclusions. Thus Barro (1991) and Barro and Sala-i-Martin (1995) who were among the pioneers of empirical research in this area have persistently argued that the cross-country income data provide empirical support of the convergence hypothesis (they use however relatively more recent, post-war data). On the other hand, the UNCTAD (1997) which analyzes longer trends of world income distribution argues that during the past 120 years divergence in per capita income levels has been the dominant trend in the world economy while convergence has been taking place mostly within a small group of industrialized countries, during certain intervals of time. The controversy arises not only from the different time horizons but also from the type of hypothesis that is being tested: that of absolute convergence (latter study) or that of conditional convergence (the former studies).

In any case, convergence is a long-run phenomenon and its testing requires a sufficiently long time horizon. As the time period for which relevant data for the candidate countries are available is quite short (just one decade), it is practically impossible to test properly any of the convergence hypotheses. Hence what we suggest below in this section should be regarded only as an empirical illustration of some of analytical the approaches used in the convergence related literature.

Table 2 illustrates a simple check of the incidence of ∃-convergence (absolute convergence) between the candidate countries and the EU-member states during the second half of the 1990s on the basis of the correlation between the initial level of per capita GDP (in this case taken as the year 1995) and the rates of growth of per capita GDP (in this case, the average rate of growth for the period 1996-2000). The first column of the table presents the correlation matrixes for the mix containing the EU-15 and different subsets of candidate countries whereas the second one refers to convergence between candidate countries alone.

Table 2. Correlation coefficients between starting levels of per capita GDP (at PPP) and rates of growth of per capita GDP for the candidate countries and the EU-member states, 1996-2000[1)]

	Candidate countries plus EU-15	Candidate countries only
Central Europe[2)]	- 0.109	0.227
Baltic States[2)]	- 0.455	0.253
Southeast Europe[2)]	0.032	-0.553
All candidate countries	- 0.102	0.088
Memo item **EU-15 only: -0.249**		

1) The year for the starting levels of per capita GDP is 1995; the rates of growth of per capita GDP are the average rates for the period 1996-2000.

2) The coverage of the country groups is as follows: Central Europe: Czech Republic, Hungary, Poland, Slovakia and Slovenia; Baltic states: Estonia, Latvia and Lithuania; Southeast Europe: Albania, Bulgaria, Croatia, FYR Macedonia and Romania

Source: Author's calculations on the basis of data from the UNECE statistical data base.

The interpretation of these coefficients is the following: a negative coefficient is in line with the absolute convergence hypothesis as it indicates that poorer countries (within the sample) tend to grow faster that richer countries (within the same sample); the greater this coefficient in absolute value, the stronger the evidence. In contrast, a positive coefficient suggests the opposite interpretation.

Overall, these results provide only weak and partial evidence of the absolute convergence between candidate countries and the EU-15 and no evidence of convergence for the candidate countries alone. Moreover, convergence for the whole set of countries (EU-15 and candidate countries) is mostly due to absolute convergence within the EU itself (correlation coefficient for the EU-15 is larger in absolute value than the correlation coefficient for the whole set of countries). However, as the time period used for this check is very short for such type of analysis, it remains to be seen how this process will evolve in the future.

Table 3 provides an illustration of the check of Φ-convergence between the candidate countries and the EU-15 as well as among the candidate countries alone. In this table the check is done through the coefficients of variation of per capita GDP levels in different groups of countries during the 1990s.

Table 3. Coefficients of variation of per capita GDP, %

	1991	1995	1999
A. Candidate countries plus EU-15			
Central Europe	35.5	34.5	31.5
Baltic states	35.2	40.1	37.8
Southeast Europe	47.1	48.2	48.1
All candidate countries	50.7	52.4	49.9
B. Candidate countries only			
Central Europe	27.8	27.2	23.9
Baltic states	6.9	12.8	16.0
Southeast Europe	32.2	30.2	27.9
All candidate countries	35.8	42.9	44.9
Memo item: EU-15 only	24.8	26.8	25.9

Notes:

1. The coefficients are defined as the ratios of the standard deviation and the average for each group or subgroup of countries. The coefficients shown for each year are computed on the basis of 3-year moving averages of per capita GDP (PPP-based) for the individual countries.

2. The coverage of the country groups is as in table 2.

Source: Author's calculations on the basis of data from the UNECE statistical data base.

Again the evidence of Φ-convergence in general is rather weak and partial. The results in panel A also tends to highlight the heterogeneity among the candidate countries: there is considerably less variation in per capita GDP levels between the EU-15 and the Central European countries than between the former and Southeast Europe, with the Baltic states in between. Overall there has been a slight decline in the variation of per capita GDP levels between the EU-15 and the candidate countries in the second half of the 1990s. Within the group of candidate countries there is strong evidence of divergence during the 1990s in terms of variation within the group taken as a whole; however within the subgroups of Central and Southeast Europe taken separately this variation tended to recede in the second half of the period.

In general, the above results suggest that the turbulent changes accompanying the process of economic and political transformation have brought about growing heterogeneity and economic divergence in the eastern part of the continent. Only a relatively small group of candidate countries (in the first place Central Europe and to a lesser extent the Baltic states) has displayed a tendency of convergence in terms of PPP-based per GDP levels to the developed market economies of western Europe.

This present state of affairs as regards the existing income gaps between EU-member states and candidate countries has serious implications as regards the future prospects for the latter. There have been some attempts to project the future growth patterns in some of the countries aspiring EU membership on the basis of the observed long-term growth patterns in other countries. The methodological background for such

studies has been the detected statistical association between long run rates of economic growth and various factors, estimated on large samples of pooled country data.[9] Following this approach, a number of studies have attempted to project the time horizon necessary for catching up with west European income levels (Fischer, Sahay and Vegh, 1998a and 1998b; Brzeski and Colombatto, 1999; Campos, 2000). Despite the fact that such studies vary considerably in their actual projections, most of them suggest that the process of catching up with the EU in terms of per capita income levels is likely to be a lengthy and difficult one. The "time distance" from this target is measured in decades even for the more advanced transition economies, and under optimistic growth scenarios. Moreover, the experience of some of the present EU-member states has shown that EU-membership by itself is not a sufficient condition for fast catching up on the more developed European economies.

3. The foundations of a catch-up process: the dynamics of factor productivity in the candidate countries vis-à-vis the EU

Although there has been a continuing debate about the driving forces of a catch-up process, an indisputable necessary (though not sufficient) condition for real convergence to take place is that of the differential growth of national economies in which the less developed, poorer countries grow faster than their rich, more developed counterparts. Hence real convergence in the first place is intimately related to the more fundamental problem of the determinants of sustained long-term economic growth in the less developed countries. Secondly, convergence in income levels with the EU will only materialize if the acceding countries maintain such a positive differential for a sufficiently long period of time.

Which can possibly be the driving forces of sustainable and high long run growth in the candidate countries? Although there might be some room for acceleration of factor accumulation, these seem to be rather limited. The demographic situation in most of these countries (with the possible exception of Poland) is not very favorable, and the age structure is likely to deteriorate further in the medium term. There is a somewhat greater potential to boost investment through higher domestic savings, especially in the less advanced among the candidate countries (such as Bulgaria and Romania); however, in the more advanced Central European countries domestic saving rates are already higher than the average saving rates in the EU-member states.[10] The alternative of raising investment through debt accumulation will hardly be sustainable in the medium and long run. Hence it appears that the main avenue to achieving sustainable and high long run rates of economic growth in the candidate countries would be through raising productivity and productive efficiency.

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9 Probably the most well known and widely quoted results in this strand of the literature are to be found in Barro (1991), Levine and Renelt (1992)

10 For example, during the period 1994-1997, the unweighted average gross domestic saving ratio in the EU-15 was 19.5%. For comparison, during the period 1996-1999, the unweighted average gross domestic saving ratio in Central Europe (the Czech Republic, Hungary, Poland, Slovakia and Slovenia) was 24.6% (ESE, 2001, pp. 171-173).

The main strand in the literature devoted to cross-country comparative empirical research on productivity is that based on multi-factor productivity measure and the notion of total factor productivity (TFP). Initially proposed in Solow's (1957) growth accounting exercise, this concept has been developed and elaborated in various directions.[11] Despite the differences, all approaches based on the notion of TFP seek to distinguish between the variation in output which is caused by variation in factor inputs and those changes in the level of output that are assumed to be attributed to the efficiency of resource transformation *per se*, i.e. the efficiency of the underlying production technology. The objective is then to fit a production function on the observed data and to filter out the above two components of output variation.

The traditional growth accounting approach has been to assume a pre-determined functional form for the production technology (in which total factor productivity is usually treated a separable factor) and estimate this function as the average function that fits the observed data. Relatively recently, with the elaboration of more sophisticated econometric approaches, the main focus of research has shifted to the attempts to estimate production frontiers expressing the "best practice" or the maximum amount of output obtainable with a given technology from a given mix of input quantities. While the traditional growth accounting techniques identify TFP with the residual of the estimated production function, these techniques allow to distinguish between the components of the productivity dynamics (such as technical efficiency and technological change).[12]

The applicability of more sophisticated approaches is crucially dependent on the availability of reliable statistics on output and factor inputs for sufficiently long periods of time. With reference to the accession candidates (which are still economies in transition from plan to market) the available data pose serious constraints as to the measurement of their TFP. One of the biggest limitations is the absence of reliable estimates of the stock of productive capital which is a basic pre-requisite for the application of any of the growth accounting methods. For the tentative evaluation of TFP in the candidate countries during the transition period, some proxies for the employed capital have been used which are described below. Due to the provisional nature of the capital stock figures, it was considered inappropriate to apply some of the more sophisticated statistical methods and techniques due to likelihood of large initial measurement errors. Our approach was thus limited to the more traditional measure of the changes in productive efficiency such as the Solow residuals.

Solow's measure is based on a Cobb-Douglas production function with constant returns to scale and autonomous and neutral technical change (which does not affect the marginal rates of substitution). The parameters of the production function coefficients in the Solow case are determined under the assumptions of profit maximizing behavior and perfect markets which yield the well known condition of equality between factor

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11 For an overview of the evolution of the notion of TFP see Hulten (2000); for an comparative survey of the different approaches in international TFP comparisons see Islam (1999).

12 Such an approach is used by Krüger, Cantner and Hanusch (2000) who estimate a "world production frontier" and evaluate the distance of individual economies from this frontier.

prices and the marginal productivity of production factors.[13] In this case the Solow residuals s_j (denoting the rate of change of TFP in country j at time t) are defined as:

$$(1) \qquad s_j(t) = d\,y_j(t) - \alpha\, d\,l_j(t) - (1-\alpha)\, d\,k_j(t),$$

where α is share of labor income in GDP; $d\ y_j$, $d\ l_j$ and $d\ k_j$ are the logarithmic differences of real GDP, real labor input and real capital input at time *t*, respectively.

An essential data requirement for implementing this approach is the primary distribution of income in the economy for the compensation of labor and capital. In the SNA framework this corresponds to the breakdown of total value added produced in the economy at factor costs (i.e. net of indirect taxes) into "compensation of employees" (labor income) and "gross operating surplus and gross mixed income" (capital income).[14] Thanks to the progress in introducing SNA in the candidate countries, it is now possible to assess their primary distribution of income during the 1990s, as shown in Table 4. For a comparison, this table contains the comparative figures for the EU-member states for the same period. Quite remarkably, the differences in the primary breakdown of aggregate income between the candidate countries and the EU-member states are not very substantial; besides the cross-country variation in this distribution within each of the two country groups is of also comparable magnitude.

As noted earlier, the greatest difficulty in applying any method of growth accounting is the absence of reliable estimates of the stock of productive capital in the candidate countries. I have used a tentative measures as a proxy for the true level of the capital stock based on an attempt to derive internationally comparable dynamic capital stock series for the candidate countries by emulating long-term capital accumulation though a simplified version of the so called "permanent inventory method".[15] This computing exercise relies on several basic data inputs: 1) the results of the latest round of the European Comparison Programme conducted in 1996 (ECP, 1996) which provides internationally comparable PPP based GDP estimates of both the candidate countries and the EU-member states; estimates of the long-run GDP growth rates in the candidate countries (before 1989, the former centrally planned economies) for the period 1950-

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13 Admittedly, these are too strong assumptions, especially for the acceding countries.

14 Note that these should be considered as proxies for the true values of factor remuneration due to some methodological specificities of SNA (for example the fact that the income of self-employed is included in the "mixed income" category).

15 The measurement of capital stocks is a general problem not only for the economies in transition but also for the industrialized countries. All available measures are basically tentative estimates and the most widely used method is the permanent inventory method, although applied at lower levels of disaggregation and by differentiating between types of physical capital. See Mas, Perez and Uriel (2000).

2000 (ESE, 2000); historic series of investment activity (investment ratios) in the candidate countries (before 1989, the former centrally planned economies).[16]

Table 4. Primary distribution of value added in the candidate countries and selected EU-member states, 1990-1999 (% of GDP net of indirect taxes, period averages).

	Labor income			Capital income		
	1990-1994	1995-1999	1990-1999	1990-1994	1995-1999	1990-1999
Candidate countries						
Bulgaria	54.0	44.0	49.0	46.0	56.0	51.0
Croatia	35.8	46.5	41.2	64.2	53.5	58.8
Czech Republic	49.9	55.7	52.8	50.1	44.3	47.2
Estonia	58.7	61.5	60.1	41.3	38.5	39.9
Hungary	66.4	54.1	60.3	33.6	45.9	39.7
Latvia	48.6	58.2	53.4	51.4	41.8	46.6
Lithuania	47.1	49.4	48.3	52.9	50.6	51.7
Poland	50.5	51.1	50.8	49.5	48.9	49.2
Romania	44.8	34.7	39.8	55.2	65.3	60.2
Slovakia	48.5	49.9	49.2	51.5	50.1	50.8
Slovenia	69.8	63.6	66.7	30.2	36.4	33.3
EU-member states						
Austria	…	60.3	60.3	…	39.7	39.7
Belgium	59.3	58.3	58.8	40.7	41.7	41.2
Denmark	63.0	62.1	62.6	37.0	37.9	37.4
France	60.6	60.8	60.7	39.4	39.2	39.3
Germany	62.3	60.0	61.0	37.7	40.0	39.0
Italy	50.7	47.7	49.2	49.3	52.3	50.8
Netherlands	57.8	57.0	57.4	42.2	43.0	42.6
Spain	54.2	55.0	54.6	45.8	45.0	45.4
Sweden	64.5	64.3	64.4	35.5	35.7	35.6
UK	64.4	62.4	63.4	35.6	37.5	36.5

Source: Author's calculations on the basis of data from the UNECE statistical data base.

16 The historic investment ratios have been taken from various issues of UNECE *Economic Survey of Europe*. The ratios of the then existing states (Czechoslovakia, USSR and Yugoslavia) have been used for the countries that succeeded them.

By using a simple conventional capital accumulation dynamic equation:

(2) Fixed capital(t) = Fixed capital(t-1) – depreciation(t) + fixed investment(t),

over a sufficiently long period of time (starting in 1950) while applying adequate norms of depreciation,[17] I have computed long-term series for the capital stock dynamics in the candidate countries.While these series may differ from historic capital stock series computed in some of the centrally planned economies in the past, in general their derivation corresponds to the widely recognized international practices. On the other hand, since the derived capital stock series are based on the rates of fixed capital consumption accepted in developed market economies, they are free from the past distorting practices of using unrealistically long average life of capital assets. Thanks to this, applying such an approach makes it possible to eliminate, at least partly, the problem of properly reflecting the seeming capital loss or sudden capital scrapping after the economic liberalization in the initial phases of transition. On the other hand, however, due to the rough nature of the exercise (performed on the aggregate level only and without a differentiation between different types of physical capital) the estimated capital stock series can only be regarded as a tentative proxy.[18]

The results for the average Solow residuals in the candidate countries in the 1990s (a measure of the rate of change of TFP) derived in accordance with (1) and using the capital proxy are shown in Table 5. The table contains comparative TFP estimates for the EU-member states for the same period in which the dynamics of their capital stock is based on World Bank estimates.[19] The results for the EU-member states are derived using the national GDP growth statistics for the 1990s.

The TFP estimates point to a similar general pattern across countries and over time. During the initial phase of transition (1990-1994) most candidate countries (with the exception of Hungary, Poland and Slovenia) on average experienced substantial

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[17] For example Hulten and Wykoff (1981) suggest the following rates of capital consumption for the US economy: 0.0361 for buildings and 0.1179 for machinery and equipment. Mas, Perez and Uriel (2000) come up with comparable numbers for Spain. For the purpose of this exercise an average rate of capital consumption of 0.075 (for the total economy) has been used for the candidate countries.

[18] Even if the stock of capital is properly measured, it is sometimes argued that this may not be a relevant measure of capital services in a production function due to the rigidity of the capital stock which cannot adjust immediately to changes in output/factor demand. This rigidity is especially pronounced on the downward side, when the observed combinations of output and factor inputs refer to a recessionary period (this would be typical for the initial phases of the transition). For these reasons, I have also computed an alternative measure of capital services on the basis of aggregate electricity consumption in the individual countries during the 1990s. The resulting TFP estimates do not differ substantially from those presented in table 5 below.

[19] While other TFP estimates for the EU-member states have also been suggested in the literature, I have refrained from using them for the purpose of maintaining methodological comparability with the estimates for the candidate countries.

drops in TFP and their productivity dynamics was substantially inferior to that in the EU-member countries. In contrast, during the phase of recovery (1995-1999), there was a sharp upturn in TFP in most candidate countries and its average rate of growth was higher than that in the EU-member states.[20] The outcomes for the decade as a whole are mixed, with some candidate countries featuring positive average TFP growth while others registering a decline. In three candidate countries (Hungary, Poland and Slovenia) the average rate of TFP growth was positive both for the two sub-periods and for the decade as a whole, and higher than that in any EU-member state.

These results provide empirical evidence that a catch up process (though a rather heterogeneous one) involving some of the candidate countries has been under way during the transition and especially in the second half of the 1990s. The speed of this process was highly differentiated among the transition economies: while some candidate countries (such as the above mentioned ones but also the Baltic countries and some other Central European economies) made significant progress in reducing the gap in productivity and income levels vis-à-vis the EU, other candidate countries (and especially those in Southeast Europe) registered only limited success in this process. Notably, the 1990s were not a period of rapid growth in TFP in the EU area either: while the average rate of TFP change for the EU-member states for the decade as a whole was positive in all countries, in most cases it did not make the most significant contribution to economic growth in this period.

Figure 1 illustrates the productivity differential between the candidate countries (aggregated for three groups of countries: Central Europe, Baltic states and Southeast Europe) and the EU average by showing the indices of their differential TFP change vis-à-vis the EU. As seen from the upper panel, during the first phase of the transition, the candidate countries experienced a deterioration in their relative TFP standing vis-à-vis the EU which was especially pronounced in the Baltic states and in Southeast Europe. In contrast, as shown on the lower panel, since 1993 basically all candidate countries have improved their relative TFP position vis-à-vis the EU; however the magnitude of this positive shift differs considerably among countries.

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[20] Note that the evidence of differential productivity growth (which is based on GDP growth accounting in national currencies) presented in this section is much stronger than the evidence of convergence in per capita income levels (as measured by PPP-based per capita GDP) presented in the previous section. The main reason is the fundamental methodological difference between the two approaches.

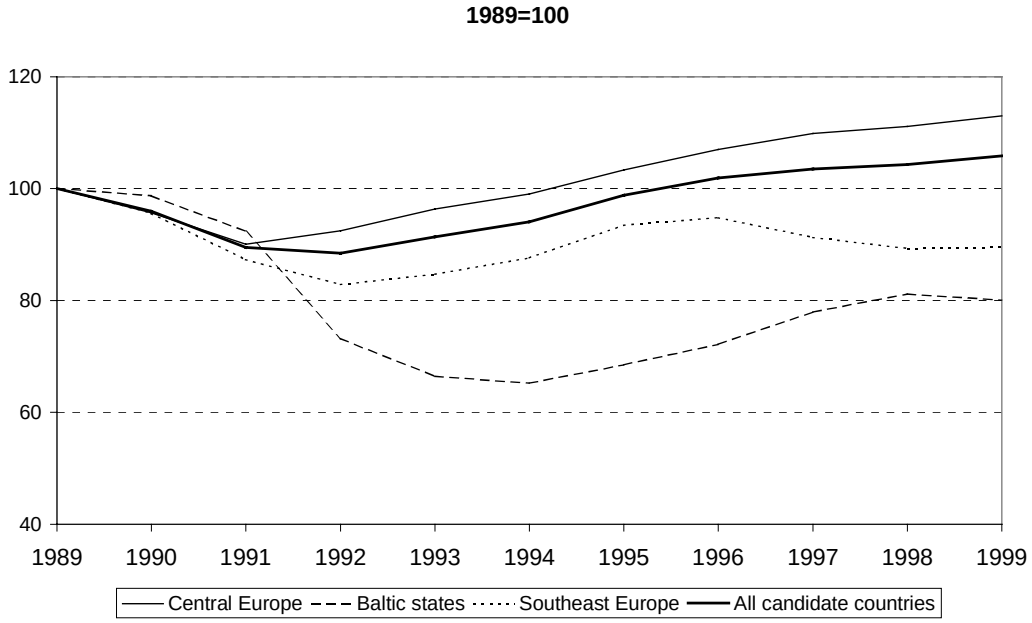
Table 5. Total factor productivity in the candidate countries and selected EU-member states, 1990-1999 (annual average rates of change – simple averages by periods, %)

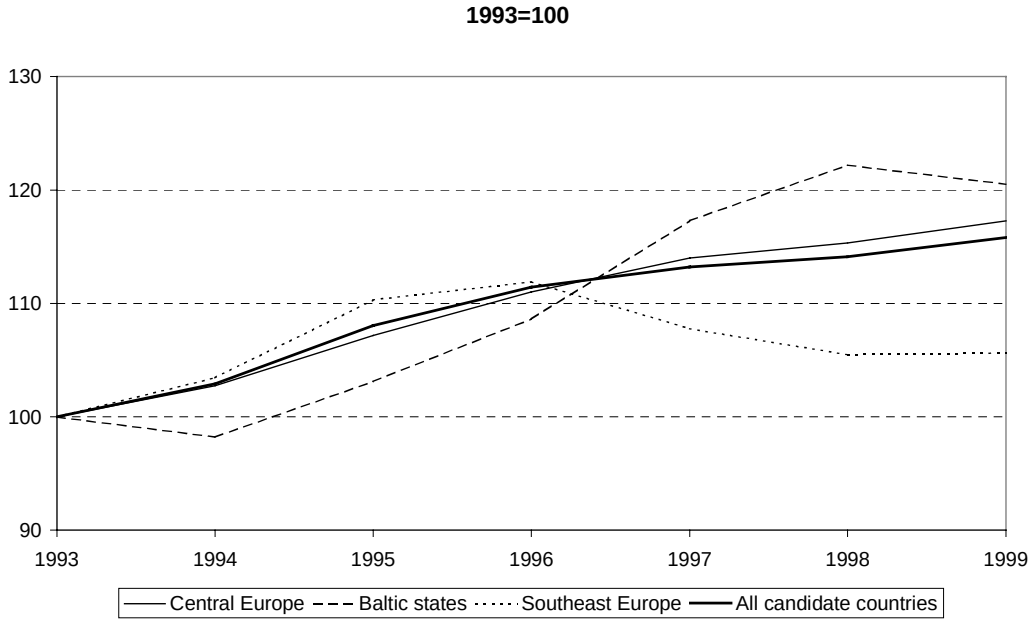
	GDP, of which:			Contribution of:						Total factor productivity		
				Labor			Capital					
	1990-1994	1995-1999	1990-1999	1990-1994	1995-1999	1990-1999	1990-1994	1995-1999	1990-1999	1990-1994	1995-1999	1990-1999
Candidate countries												
Bulgaria	-4.9	-1.7	-3.3	-2.9	-0.4	-1.7	-1.4	-2.1	-1.7	-0.6	0.9	0.1
Croatia	-8.4	4.4	-2.0	-2.0	0.2	-0.9	-2.8	0.0	-1.4	-3.6	4.1	0.2
Czech Republic	-2.2	1.5	-0.4	-0.9	-0.5	-0.7	0.3	0.9	0.6	-1.6	1.1	-0.3
Estonia	-8.6	4.5	-2.0	-2.2	-1.1	-1.6	-0.8	0.0	-0.4	-5.6	5.5	0.0
Hungary	-3.2	3.4	0.1	-4.0	0.1	-2.0	-0.6	0.0	-0.3	1.4	3.2	2.3
Latvia	-11.3	3.0	-4.2	-2.5	-0.6	-1.5	-2.4	-1.0	-1.7	-6.4	4.6	-0.9
Lithuania	-11.2	3.3	-4.0	-1.1	-0.2	-0.6	-1.0	-1.2	-1.1	-9.1	4.6	-2.3
Poland	-1.4	5.8	2.2	-1.6	0.9	-0.3	-1.1	1.0	-0.1	1.3	3.8	2.6
Romania	-4.4	-0.7	-2.5	-0.9	-0.9	-0.9	-1.1	-0.4	-0.8	-2.4	0.7	-0.9
Slovakia	-4.5	5.3	0.4	-1.4	0.0	-0.7	0.7	0.5	0.6	-3.8	4.8	0.5
Slovenia	-2.9	4.2	0.7	-3.2	0.1	-1.5	-0.5	0.7	0.1	0.9	3.3	2.1
EU-member states												
Austria	2.4	2.0	2.2	0.3	0.3	0.3	1.5	1.0	1.2	0.7	0.7	0.7
Belgium	1.6	2.5	2.0	-0.1	0.5	0.2	2.0	1.4	1.7	-0.3	0.5	0.1
Denmark	1.6	2.5	2.1	-0.3	0.7	0.2	0.6	1.4	1.0	1.3	0.4	0.9
France	1.3	2.1	1.7	-0.1	0.5	0.2	1.4	1.1	1.3	-0.1	0.5	0.2
Germany	2.1	1.5	1.8	-0.1	0.2	0.1	1.2	0.8	1.0	1.0	0.5	0.7
Italy	1.1	1.7	1.4	-0.1	0.3	0.1	1.1	0.7	0.9	0.1	0.8	0.4
Netherlands	2.5	3.4	3.0	0.9	1.6	1.2	1.2	1.2	1.2	0.4	0.6	0.5
Spain	1.6	3.5	2.5	-0.5	1.4	0.5	2.3	1.5	1.9	-0.3	0.6	0.1
Sweden	0.2	2.7	1.4	-1.4	0.5	-0.5	1.0	0.7	0.9	0.6	1.5	1.0
UK	1.2	2.7	2.0	-0.7	0.8	0.0	1.3	1.3	1.3	0.6	0.7	0.7

Note: Labor input is approximated by the annual average number of employees in the economy.

Source: Author's calculations on the basis of data from the UNECE statistical data base, author's estimates of the dynamics of capital in the candidate countries and World Bank estimates of the dynamics of capital in the EU-member states (Easterly and Levine, 2000).

Figure 1. TFP dynamics in the candidate countries: indices of differential change vis-à-vis the EU average (EU average = 100)





Note. The coverage of the country groups shown on Figure 1 is as follows:

Central Europe: Czech Republic, Hungary, Poland, Slovakia and Slovenia.

Baltic states: Estonia, Latvia and Lithuania

Southeast Europe: Bulgaria, Croatia and Romania.

4. Differential productivity growth and the dynamics of real exchange rates in the candidate countries: testing the Balassa-Samuelson effect

As noted above, a catch up process involving differential productivity growth affects the dynamics of the real exchange rate in the catching up economy (the Balassa-Samuelson effect): the fundamental (or equilibrium) real exchange rate in an economy displaying a sustained productivity catch up tends to appreciate relative to the economies growing at a slower pace. Applied to the context of the envisaged EU accession, this means that as long as the process of catching up on the EU in productivity and income levels continues, it is going to be accompanied by a parallel process of real appreciation of the currencies of the candidate countries vis-à-vis the Euro. In this section we test the Balassa-Samuelson conjecture in the context of the envisaged EU enlargement and some of its implications for the candidate countries.

The Balassa-Samuelson conjecture is based on several main assumptions for an open economy: 1) productivity in the tradable sector grows faster than that in the non-tradable sector; 2) the bias of productivity levels in favor of the tradable sector is larger in high-income countries; 3) wages tend to equalize within the economy. Then the following transmission mechanism is set in motion. Rising productivity in the tradable sector implies that wages in this sector will also tend to rise faster than those in the non-tradable sector. Due to the trend towards economy-wide wage equalization, wages in the non-tradable sector tend to follow the dynamics of those in the tradable sector. However, because of the productivity gap, the non-tradable sector will only be able to pay higher wages if the rising costs are passed to the consumers. Consequently, prices in the non-tradable sector will tend to rise faster relative to those in the tradable sector, the speed of relative price change being dependent on the productivity differential between the two sectors. Since the productivity gap is larger in high-income countries, their general price level (usually associated with CPI) will also tend to be higher than that in low income countries while their currency will tend to be more expensive in nominal terms. However, if a low income country embarks on a fast catch up process (based on a productivity differential in the tradable sector vis-à-vis the high-income country), its CPI will also tend to grow relatively faster while its (CPI-based) real exchange rate will tend to appreciate. The Balassa-Samuelson conjecture measures purely supply side effects under the assumption of perfect markets. It should be added that demand factors and/or market imperfections on the supply side may also affect the dynamics of the real exchange rate, at least in the short run.

There are various extensions of the basic Balassa-Samuelson conjecture. Froot and Rogoff (1995) derive a generalization for a small open economy under perfect capital mobility, constant returns to scale and instantaneous adjustment on the factor markets which suggests even stronger trend towards real appreciation in high income countries. In their derivation, if the tradable sector is more capital intensive (equally, if the non-tradable sector in relatively more labor intensive), then this alone would lead to rising relative price in the non-tradable sector, even in the case of balanced productivity growth (when productivity in both sectors grows at the same rate). The greater the

capital intensity gap (as is usually the case in high income countries), the greater the real appreciation of non-tradable goods (hence, CPI).

Begum (2000) derives a closed-form solution for the Balassa-Samuelson effect on the basis of a two-country dynamic general equilibrium model. It follows directly from this derivation that a productivity shock in the tradable sector of one the country (which yields a positive productivity differential in this sector) causes an appreciation of the real exchange rate in that country. Conversely, it is shown that a mirror productivity shock in the non-tradable sector of one of the countries results in real depreciation of the exchange rate.

The Balassa-Samuelson effect has been tested extensively in empirical studies and most of these provide evidence in support of this conjecture.[21] Begum's (2000) model is also tested empirically on the basis of quarterly data for the G-7 countries for the period 1960-1997 and these tests provide statistically robust evidence in support of the theoretical results, namely, that productivity differentials between home and foreign country may be important determinants of real exchange rate movements. Halpern and Wyplosz (2001) are the among first to have tested empirically the Balassa-Samuelson effect for the economies in transition. They regress the relative prices of non-traded goods in a cross-section of transition economies on the productivity differential between the tradable and the non-tradable sectors and find statistically significant evidence of a positive inference. Their analysis also provides evidence that after 1992-1993, relative productivity in industry in the candidate countries was growing considerably faster than that in services.

In the following I present further evidence in support of the Balassa-Samuelson conjecture for the candidate countries and provide an alternative – and straightforward – test of this effect with direct inferences for the dynamics of their real exchange rates.

First, a look at the dynamics of the real exchange rates in the candidate countries during the 1990s. Table 6 and Figure 2 report on three types of real effective exchange rate indices for selected candidate countries during the 1990s: 1) deflated by the CPI differential; 2) deflated by the PPI differential and 3) deflated by the unit labor costs (ULC) differential.[22] The effective rates are computed in a simplified form vis-à-vis a US$-DM/Euro currency mix with weight of the latter corresponding to the share of the EU in the trade flows of each individual country. As to the price/ULC differentials, the corresponding price/ULC data are those for the US and Germany.[23]

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21 See Froot and Rogoff (1995) for a comprehensive review of the empirical literature.

22 Due to absence of relevant price data for the tradable and non-tradable sectors, we approximate the first with the PPI index whereas the CPI index is a weighted average of the two.

23 These computations are based on data from UNECE statistical data base. For the candidate countries ULC are those for the sector of industry (mining, manufacturing and electricity); for the US and Germany ULC indices for the total economy are taken (OECD, 2000).

Table 6. Indices of the real effective exchange rate in the candidate countries, 1990-1999 (1993=100)

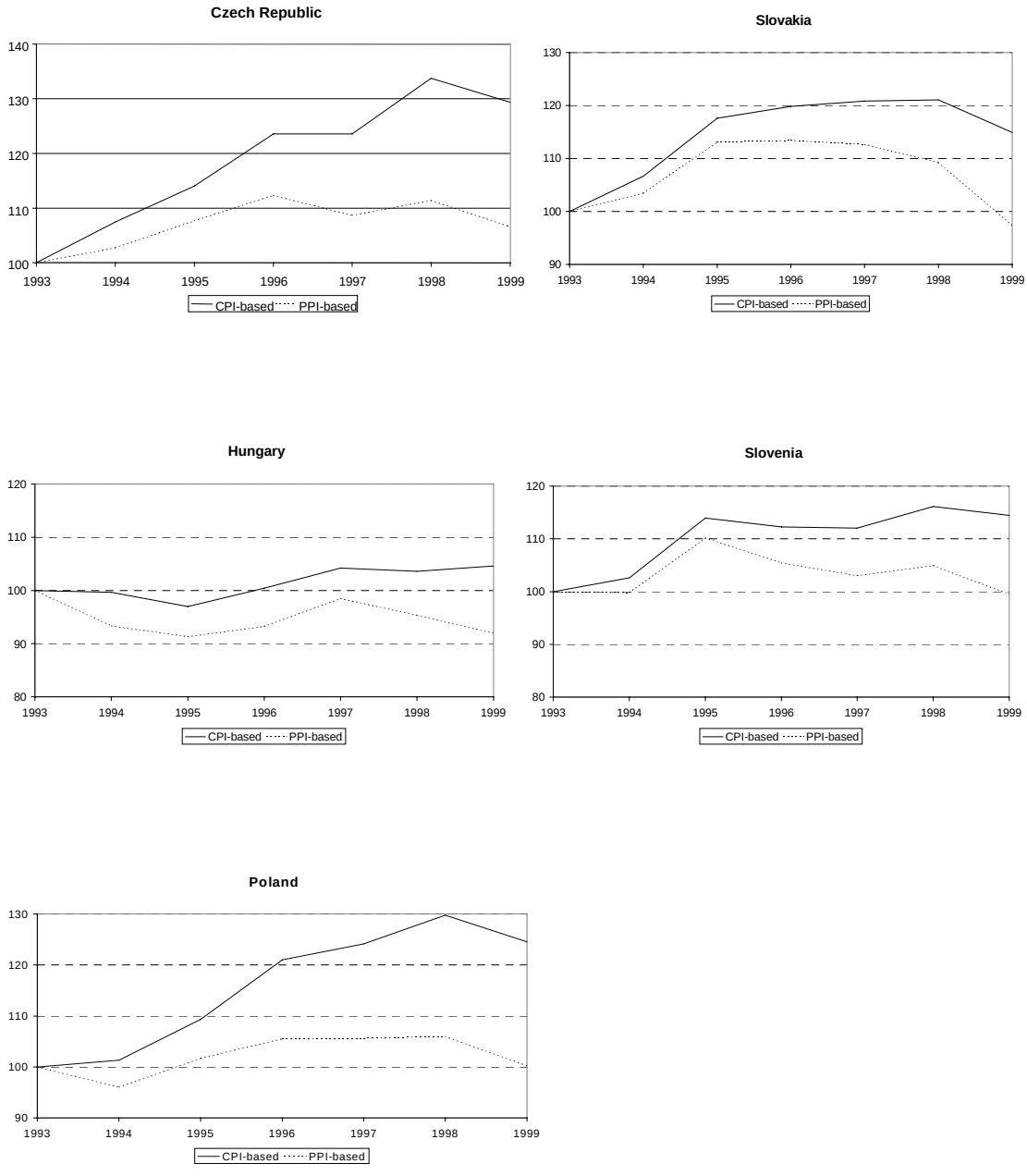
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Based on CPI										
Bulgaria	47.9	54.0	69.2	100.0	95.7	117.3	99.4	128.4	148.3	143.3
Croatia	..	165.5	84.3	100.0	113.8	120.8	123.1	121.6	122.9	115.6
Czech Republic	83.7	79.8	85.7	100.0	107.4	114.1	123.6	123.6	133.8	129.3
Estonia	..	..	58.5	100.0	146.7	196.5	234.5	241.9	258.5	259.8
Hungary	80.5	89.1	96.0	100.0	99.6	96.9	100.5	104.2	103.6	104.6
Latvia	..	..	..	100.0	159.0	194.3	221.0	240.4	248.0	259.3
Lithuania	..	..	..	100.0	183.9	238.6	297.4	338.4	354.7	360.9
Poland	65.0	96.8	98.9	100.0	101.3	109.4	121.0	124.1	129.7	124.5
Romania	127.5	103.8	70.5	100.0	104.5	102.5	94.4	110.2	141.3	120.3
Slovakia	82.4	81.6	88.8	100.0	106.7	117.6	119.9	120.8	121.1	114.9
Slovenia	..	108.9	104.3	100.0	102.6	113.9	112.2	112.0	116.2	114.5
Based on PPI										
Bulgaria	88.4	90.3	94.2	100.0	85.4	98.6	89.4	100.2	109.3	108.5
Croatia	..	137.4	84.6	100.0	102.3	107.2	107.0	104.4	98.6	91.4
Czech Republic	86.1	89.2	94.8	100.0	102.8	107.7	112.3	108.7	111.4	106.6
Estonia	..	..	63.4	100.0	135.4	176.6	196.6	198.4	204.2	196.2
Hungary	99.2	107.9	106.1	100.0	93.3	91.3	93.2	98.5	95.3	92.0
Latvia	..	..	..	100.0	136.8	149.7	164.5	171.9	172.6	169.1
Lithuania	..	..	..	100.0	154.6	184.4	216.2	239.4	229.5	238.6
Poland	85.7	105.5	101.4	100.0	96.0	101.7	105.5	105.7	106.0	100.2
Romania	157.6	152.0	94.8	100.0	106.1	106.4	105.8	124.5	133.9	111.2
Slovakia	86.3	89.6	93.4	100.0	103.4	113.1	113.4	112.6	109.3	97.3
Slovenia	..	115.8	114.0	100.0	99.8	110.2	105.4	103.0	104.9	99.5
Based on ULC										
Bulgaria	59.9	45.6	76.1	100.0	68.9	80.3	60.8	67.4	95.2	100.3
Croatia	..	195.4	168.1	100.0	118.6	153.6	96.0	84.1	156.5	121.7
Czech Republic	81.0	70.6	86.0	100.0	109.0	126.9	141.0	128.5	135.6	132.9
Estonia	..	..	107.1	100.0	150.1	179.4	122.7	107.6	211.1	166.5
Hungary	83.0	98.1	111.6	100.0	93.3	82.5	78.8	71.8	67.5	62.4
Latvia	..	..	..	100.0	166.2	171.9	109.6	106.7	197.0	157.8
Lithuania	..	..	..	100.0	160.7	179.7	139.5	142.9	280.2	219.6
Poland	83.8	119.9	109.1	100.0	98.1	110.5	113.9	101.1	103.0	97.3
Romania	160.0	134.3	92.0	100.0	98.8	105.1	100.5	82.2	118.5	102.0
Slovakia	95.2	79.9	92.9	100.0	104.0	116.6	125.1	120.3	113.7	103.3
Slovenia	..	86.2	183.8	100.0	96.5	96.5	55.9	45.0	84.4	64.4

Notes:
1. A change of the index in the upward direction indicates real appreciation and vice versa.
2. For definitions of variables see text.

Source: Author's calculations on the basis of data from the UNECE statistical data base.

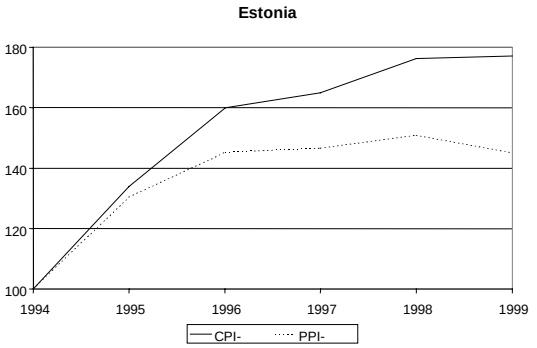
Figure 2. Dynamics of the real effective exchange rates in the candidate countries

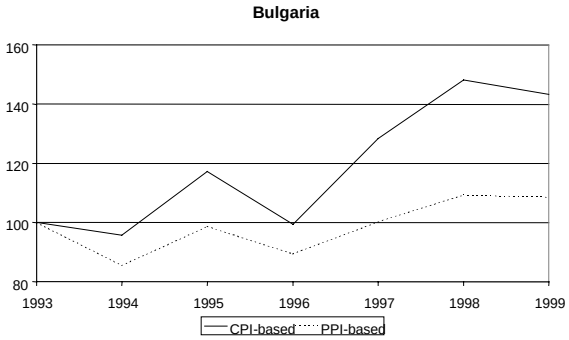
A. Central Europe

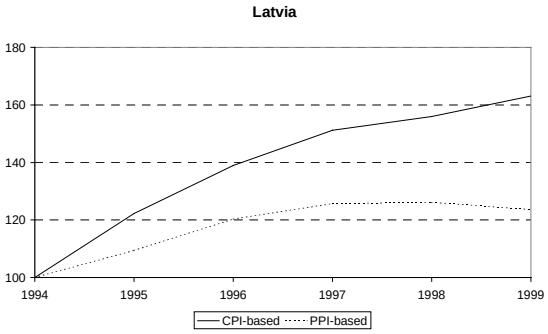


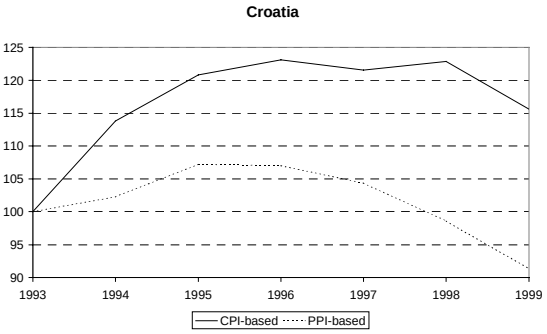
B. Baltic states

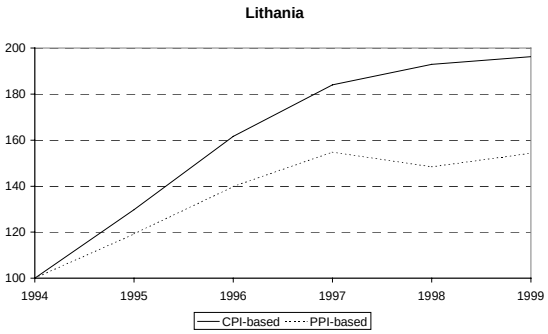
C. Southeast Europe

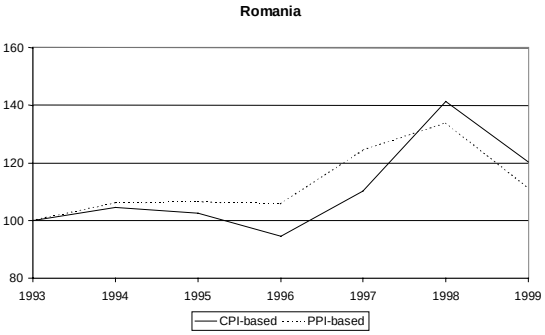












These data suggest some common patterns in the dynamics of the real exchange rates in the candidate countries which can be summarized in the following stylized facts:

- The general trend in all candidate countries during the 1990s was toward real exchange rate appreciation, especially in terms of the CPI deflated real effective exchange rate; the degree of real appreciation, however, varies considerably across countries.
- After the opening of the economies at the start of the transition (which was accompanied by gradual price and trade liberalization), the real appreciation was especially fast, likely reflecting the ongoing restructuring of domestic relative prices and the gradual lifting of administrative price controls (the latter usually kept prices below equilibrium level).
- The Baltic states experienced such fast real appreciation in 1992/1993-1995 which was reinforced by an initial undervaluation of their (new) currencies.
- The PPI-deflated real exchange rates have systematically lagged behind the CPI-deflated real exchange rates in all candidate countries with the possible exception of Romania (Figure 2).
- The same is generally valid for the ULC-deflated real exchange rates although the latter displays more volatility and its trends are non-monotonic.

The last two patterns can be treated as indirect evidence which is in conformity with the Balassa-Samuelson conjecture. Indeed the deviation between the PPI- and CPI-deflated exchange rates reflects in effect differential growth between the prices of tradable goods (approximated by PPI) and non-tradable goods (as exhibited in CPI which is a weighted average of the two). The divergence between the two is in line with what could be expected from the Balassa-Samuelson effect. The fact that both the PPI- and especially the ULC-deflated real exchange rate lag behind the dynamics of the CPI-deflated one suggests that as regards the supply side effects, the real exchange rate dynamics was not driven by cost pressures and hence did not result in deterioration in competitiveness. This is also in conformity with the Balassa-Samuelson conjecture which suggests that the productivity driven real exchange rate appreciation takes place in the context of an equilibrium growth path.

Now I turn to a direct illustration and estimation of the Balassa-Samuelson effect for the candidate countries. As the focus of this study is on catching up in Europe (candidate countries vis-à-vis the EU), I analyze the real exchange rates in the candidate countries vis-à-vis the Euro (before 1999, the DM). This analysis is performed in the context of the following simple theoretical framework. Assume a two-sector, two-country model where each economy contains a tradable and a non-tradable goods sectors. Also assume that the non-tradable sector in each economy employs an identical technology[24] whereas the technologies in the tradable sectors may differ. Under these assumptions, we can infer the following qualitative relations between the variables that

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[24] This is in conformity with one of the underlying assumptions of the Balassa-Samuelson conjecture, namely, that productivity in the non-tradable sector does not vary substantially across countries.

are of interest to us: 1) differential productivity growth in the tradable sectors of the two economies would also unequivocally yield differential productivity growth for the economies as a whole; 2) if the Balassa-Samuelson mechanisms is in motion, this differential productivity growth would yield real appreciation of the exchange rate in the economy with a positive productivity differential.

Under these assumptions, if the candidate countries exhibit higher productivity growth in their tradable sectors than the EU (and hence higher productivity in the economy as a whole), their CPI-based real exchange rates vis-à-vis the euro would tend to appreciate and this is the main relation that is subject to empirical analysis. Due to the absence of relevant total factor productivity data for the tradable sector proper (for the candidate countries) I use instead the total factor productivity estimates for the economy as a whole (as well as the productivity differentials vis-à-vis the EU) presented in the previous section.

It should be noted (and this can be traced in Table 6 and on Figure 3) that the initial phase of transition (and for the Baltic countries – the initial years after the introduction of their currencies), the dynamics of the real exchange rates was subject to various effects due to the ongoing deep structural changes in the candidate countries. Thus if we would like to trace "pure" productivity-driven changes in the real exchange rate we would probably come across a considerable level of "noise" in the data. For this reason, I have restricted this part of the study to the latest phase, starting from 1993 for Central and Southeast Europe and 1994/5 for the Baltic countries.

Figure 3 illustrates graphically the relation between the productivity differential indices and the CPI-based real exchange rate indices for the candidate countries suggesting for the most part a strong positive correlation. This positive correlation is clearly manifest for Central Europe and the Baltic states but to a lesser extent for some of the Southeast European countries.

Finally I estimate an equation for the real exchange rate on the basis of the available unbalanced panel data for the candidate countries. The dependent variable is the index of the CPI-based real exchange rate vis-à-vis the Euro/DM. The main independent variable in the index of differential TFP growth in the candidate countries vis-à-vis the EU average as defined in the previous section. Naturally the expected sign of the coefficient of this key variable is positive.

To take into account of demand side factors I have included some additional independent variables on the right hand side of the equation. The level of per capita income may also affect the relative prices of non-tradable goods (and hence the real exchange rate) as it has been observed that in high-income countries the aggregate consumer preferences shift towards non-traded goods. Income is reflected in the equation by the PPP-based GDP per capita in the candidate countries. The fiscal stance also affects aggregate demand and thus the real exchange rate. To account for this I have included a variable defined as the index change in the share of total general government expenditure (in proportion to GDP) between two subsequent years.[25] The expected signs of the coefficients of the demand side variables are positive.

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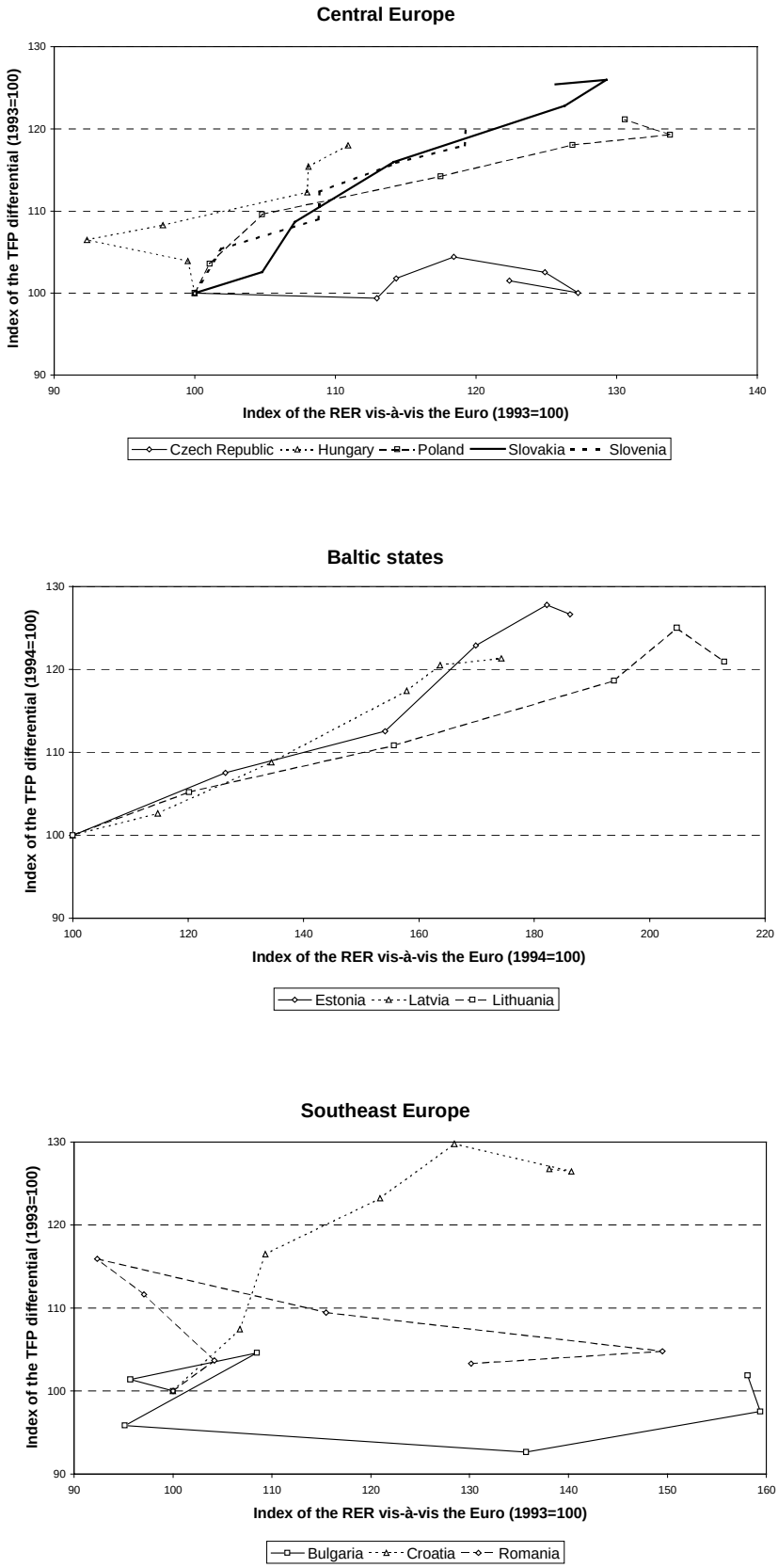
25 However fiscal data were only available starting from 1995 and given the lagged effect, they could only be used for the period after 1996.

Figure 3. Real exchange rates vis-à-vis the Euro (CPI based) and FTP differential vis-à-vis the EU average in the candidate countries, 1993-1999



The exchange rate regime may also strongly affect the dynamics of the real exchange rate. Thus in the case of a fixed regime (and a pegged nominal exchange rate), the real exchange rate appreciation is forced to be absorbed through price inflation (Halpern and Wyplosz, 2001). In contrast, a more flexible exchange rate regime (in the first place a free float but also a managed float or crawling peg/band) allows the real appreciation to be absorbed through a differential dynamics in prices and nominal exchange rate movements. I control for the exchange rate regime through panel dummies defining three types of exchange rate regimes (taking values 1 for the countries adhering to a regime of specific type in any specific year and 0 otherwise): 1) no nominal exchange rate flexibility (a fixed peg); 2) limited flexibility, with a commitment by the monetary authorities to a nominal target (crawling peg/band or managed float); 3) full flexibility (free float).

Monetary policy also may affect the dynamics of the real exchange rate, especially in the case when the authorities target specific levels of the nominal exchange rate (regime 2). To take this effect into account I also include a monetary ratio defined as the share of money supply (M1) in GDP. To take into account the possibility that additional factors are not captured by the specification I have also included year dummies (which my be relevant for the earlier years).

Thus the estimated equation has the following form:

$$(3) \qquad r = a_0 + a_1\, tfp + a_2\, y + a_3\, e + a_4\, m + a_5\, D_{xr}(i) + [a_6\, D_{year}(i) +]\ \varepsilon,$$

where:

r is the log of the index of the CPI-based real exchange rate vis-à-vis the Euro/DM;

tfp is the log of the index of differential TFP growth in the candidate countries vis-à-vis the EU average:

y is log of per capita GDP (measured in US$ at PPP);

e is the log of the change in the share of general government expenditure in GDP from the previous year (in turn, the dynamics of the expenditure share is defined as an index to ensure plausibility of the value range in logs);

m is the log of the share of M1 in GDP;

$D_{xr}(i)$ are exchange rate regime dummies, applied alternately: $D_{xr}(1)$ corresponds to the absence of nominal exchange rate flexibility (a fixed peg regime); $D_{xr}(2)$ – to limited nominal flexibility (crawling peg/band or managed float) and $D_{xr}(3)$ – to full nominal exchange rate flexibility (free float);

$D_{year}(i)$ are year dummies used in some specifications.

As the equation is estimated in logarithms, most of the estimated coefficients can be interpreted as elasticities. The estimations were performed for two sub-periods: 1993-1999 (no fiscal data), and 1996-1999 (with fiscal data).[26] The first set of

[26] The estimations for other sub-periods did not produce significantly different results.

estimations were performed on an unbalanced panel of data (with the Baltic countries starting from 1994) whereas the second set made use of a balanced panel. After testing different estimation methods, the preferred one was generalized least squares (GLS) with cross-section weights which takes into account (and corrects for) the presence of cross-section heteroskedasticity (due to the clustering of the residuals in the panel along cross-sections). The estimation results are shown in Table 7.

All estimations suggest that the equation explains a very high degree of the variation in the dependent variable. Most importantly, the key (productivity differential) variable is estimated as highly significant and has the expected sign (positive, as argued above). The demand-related variables also have the correct signs and are statistically significant, although in some cases at lower significance levels.

Two of the exchange rate regime dummy variables produced statistically significant coefficients: type 1 (no flexibility) and type 2 (limited flexibility), the latter in conjunction with the monetary policy variable. In both cases the signs of the coefficients were in line with the expectations. In the first case the coefficient was positive suggesting that a fixed nominal exchange rate is associated with faster real exchange rate appreciation compared to any of the more flexible regimes. The interpretation is the following: in this period relatively high inflation still prevailed in the candidate countries and in the absence of nominal exchange rate flexibility this resulted in real exchange rate appreciation anyway; on top of that, the Balassa-Samuelson effect was forced through additional price inflation leading to even faster real appreciation.

In the case of limited flexibility, with a commitment by the monetary authorities to a nominal target the coefficient of the exchange rate regime dummy was negative but in association with a positive coefficient of the monetary policy variable. This combination also offers a plausible interpretation: when we control for the absence of full flexibility of the nominal exchange rate, a more expansionary monetary policy (implying higher inflation) would tend to lead to real exchange rate appreciation while the regime of limited nominal flexibility would tend to be associated with slower real appreciation compared to the two extreme regimes (fixed peg and free float).

The inclusion of third exchange rate regime dummy (full flexibility) did not produce statistically significant coefficients. The year dummies were estimated as statistically significant for some of the initial years. Finally, there are no dramatic differences between the estimation results for the full time period and the shorter (more recent) period.

Turning to the interpretation of the estimated coefficients, the plain regressions of the real exchange rate on the TFP differential suggest an elasticity close to 1.0 or slightly higher. This result (which can be interpreted as representing the long run behavior of the real exchange rate) implies that a one percentage point of higher productivity growth in a candidate countries than the average productivity growth in the EU can be expected to yield a one percentage point of appreciation of its CPI-based real exchange rate.

Table 7. Estimation results for the real exchange rate equation for the candidate countries

Dependent variable: Real exchange rate vis-à-vis the Euro, CPI based (index)
Estimation method: Generalized least squares with cross-section weights.
All variables are in logs; when indices are used, the latter were expressed in %.

Estimation	1	2	3	4	5	6	7
Period[1)]	1993-1999	1993-1999	1993-1999	1993-1999	1993-1999	1996-1999	1996-1999
Included observations	7	7	7	7	7	4	4
Number of cross-sections used	11	11	11	11	11	11	11
Total panel	74	74	74	74	74	44	44
Constant	-0.061	-0.717***		-0.614			
	(-0.16)	(-2.98)		(-1.635)			
TFP differential vis-à-vis the EU (index)	1.041***	1.351***	1.023***	1.284***	1.016***	0.782***	0.958***
	(5.67)	(11.5)	(281.1)	(6.95)	(61.6)	(11.0)	(37.8)
GDP per capita, PPP-based (ths. USD)						0.116***	
						(3.06)	
Government expenditure, % of GDP (change from t-1)						0.492***	0.950**
						(3.04)	(2.28)
Money (M1), % of GDP				0.065*	0.057**		0.159***
				(1.930)	(2.08)		(3.78)
Exchange rate regime type 1,[2)] dummy (no flexibility)		0.092***	0.089***			0.163***	
		(8.08)	(10.4)			(22.7)	
Exchange rate regime type 2,[2)] dummy (limited flexibility)				-0.036***	-0.058***		-0.096***
				(-2.92)	(-4.40)		(-6.31)
Year dummies							
1993			-0.064***		-0.083***		
			(-4.07)		(-4.27)		
1994			-0.102***		-0.089***		
			(-8.35)		(-5.15)		
1995			-0.076***		-0.075***		
			(-6.19)		(-4.32)		
1996			-0.040***		-0.033*		
			(-3.24)		(1.89)		
Adjusted R2	0.993	0.999	0.998	0.996	0.995	0.999	0.998
S.E. of regression	0.072	0.063	0.049	0.072	0.063	0.043	0.073
Weighted mean of dependent variable	2.526	3.323	2.610	2.621	2.490	3.382	2.958
Weighted S.D. of dependent variable	0.868	2.401	1.240	1.145	0.090	2.237	1.569

t-values in parentheses:
*** - significant at the 1% significance level;
** - significant at the 5% significance level;
* - significant at the 10% significance level.

[1)] The starting year for Estonia, Latvia and Lithuania is 1994.
[2)] For a definition of the exchange rate regimes see text.

When demand factors are also taken into account in the estimated equation (such as the income level and the government expenditure variable), the estimated elasticity drops to 0.8 – 0.9, indicating that demand side factors also tend to affect the dynamics of the real exchange rate, at least in the short run. The estimated elasticity of the income variable is around 0.1 suggesting that, *ceteris paribus*, a one percentage point autonomous rise in the (PPP-based) per capita GDP level can be expected to yield a 0.1 percentage point of appreciation of its CPI-based real exchange rate. The coefficient of the money supply variable (which was estimated in the range of 0.05 to 0.15) has a similar interpretation (provided one also controls for the exchange rate regime). In turn, while the estimated coefficient of the government expenditure variable is positive and equals 0.6, this coefficient does not have a straightforward interpretation due to the definition of the variable used in the regression.

5. Policy implications and conclusions

The main empirical findings in the paper can be summarized up in several main conclusions:

- at present there are very substantial gaps in the per capita income levels between most of the candidate countries and the EU average;
- recently, and most notably during the second half of the 1990s, the candidate countries have embarked on a path of recovery and the leading countries have made some progress in catching up with the EU;
- the relatively fast recovery in the candidate countries has for the most part been driven by a productivity catch up;
- the catch up process has been accompanied by widespread and well pronounced real appreciation of the exchange rates in the candidate countries;
- the empirical testing of the Balassa-Samuelson conjecture suggests roughly a one-to-one proportion between the productivity differential and the CPI-based real exchange rate appreciation in the second half of the 1990s.

These findings and, in particular, the identified strong link between catching up and real exchange rate appreciation in the candidate countries have important policy implications for the countries aspiring membership in the EU and the EMU. Roughly speaking, if the same relation continues to hold,[27] each percentage point of higher rate of (productivity based) GDP growth in the candidate countries can be expected to be accompanied by a percentage point of real exchange rate appreciation. Under a fixed exchange rate regime the real exchange rate appreciation will have to be accommodated by an equiproportionate differential in CPI vis-à-vis the EU (catch up inflation); under a more flexible exchange rate arrangement the appreciation will be shared between price and exchange rate changes. In all cases, as long as the catch up process will be under way, the candidate countries are likely to be faced with the incidence of rates of inflation exceeding those that prevail among the EU-member states.

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27 Admittedly, this relation is an empirical one and there is no guarantee that it will continue to hold with the same strength in the future.

Hence, aiming at a rapid rate of convergence to the inflation rates prevailing in the EU while at the same time striving for quickly catching-up on the per capita income levels in the EU can to some extent be regarded as conflicting and mutually exclusive objectives. As follows from the analysis in the paper, closing the present gaps in per capita incomes would involve a dynamic and interactive process of changes in both productivity and price levels. Thus if the acceding countries are to grow faster than the EU, this is likely to be accompanied by inflation rates which will also be higher than that in the EU and hence nominal convergence (in the sense of convergence in the rates of inflation) will be difficult to attain.

The higher rate of inflation in a catching-up economy may in no way be linked to lax policy; it simply reflects and registers the fact that productivity convergence brings about convergence in wage and price levels as well. In other words, a process of productivity catch-up implies a dynamically changing macroeconomic equilibrium which entails a catch up in price levels. This is a fundamental feature of the ongoing structural change and policy cannot prevent it from happening if a fast catch-up process is under way. In other words, the catch up inflation that emerges during a dynamic process of productivity catch up (and which is driven by the speed of the latter) can in no way be related of disequilibria in the economy; on the contrary, this is an inherent feature of its equilibrium growth path.

The incidence of catch up inflation is an issue which requires special attention by policy makers in the acceding countries (or for that matter by the EU as well) when defining the policy objectives and their timing during the pre-accession phase. If macroeconomic policy is about equilibrium, then it should aim at sustaining equilibrium in dynamics; hence, if a process of productivity catch-up is under way then policy should target rates of change in the price level and/or in the nominal exchange rate that are consistent with the underlying catch up process. In addition, this implies a much deeper compositional analysis of the nature and sources of inflation in the candidate countries.

Any attempt by policy to hold rates of CPI inflation (in the case of pegged exchange rates) or combinations of rates of CPI inflation and nominal exchange rate changes (in the case of flexible exchange rate regimes) below those implied by the underlying process of productivity-*cum*-price catch up may in fact push the economy below its equilibrium performance path. The danger of such a policy is that it may brake the very process of productivity catch up (and fast growth) that produced the relatively faster growth of prices in the first place.

An on-going process of fundamental structural change and productivity catch up necessitates sufficient degrees of nominal flexibility since the real adjustments impose restructuring of relative prices (including real exchange rates), and the latter are effectuated through differential changes in nominal variables.[28] In this sense the nominal exchange rate is a key variable that can and does absorb the required adjustments and hence in this period it is essential that there be sufficient nominal

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28 In fact, a different reading of the data in Table 1 is that if the candidate countries are to attain per capita income levels comparable to those observed in the member states of the European Union, the average level of their domestic (nominal) prices will also have to increase to the average price levels in the west European economies.

exchange rate flexibility. In turn, the exchange rate regime is the key policy instrument for this purpose, and provides policy options that could allow the economy to undergo more smoothly the required adjustments. In this sense, the prolonged sticking to a fixed nominal exchange rate (not to speak of premature elimination of the exchange rate mechanism as a policy instrument) may not be the most efficient long-term policy course during the pre-accession phase. A rigid fixed exchange rate regime may be an efficient policy instrument for short-term macroeconomic stabilization during the initial phases of transition; however, maintaining a fixed exchange rate during a period of high and sustained economic growth (which is expected to feature in the pre-accession phase) might be questionable in view of the need to accommodate the accompanying real appreciation.

As has been observed in the literature, real exchange rate appreciation can be regarded as the equilibrium outcome of successful transformation; transition will be complete when real appreciation stops (Halpern and Wyplosz, 1997). There is nothing that policy can do to change or reverse this outcome; policy makers have rather to comply with the implications and side effects of this fundamental economic change and tune their policies accordingly. In particular, during the pre-accession phase the candidate countries will need sufficient degrees of nominal flexibility in order to accommodate the structural changes accompanying a catch up process. Hence, from the point of view of social welfare in the acceding countries, the wisdom of a policy aimed at premature inflation convergence with the EU (that is, at convergence in rates of CPI inflation before convergence in productivity and price levels is achieved) may be questionable. The goal of nominal convergence on the way to EU accession cannot be de-coupled from the goal of real convergence and these need to be pursued in conjunction.

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